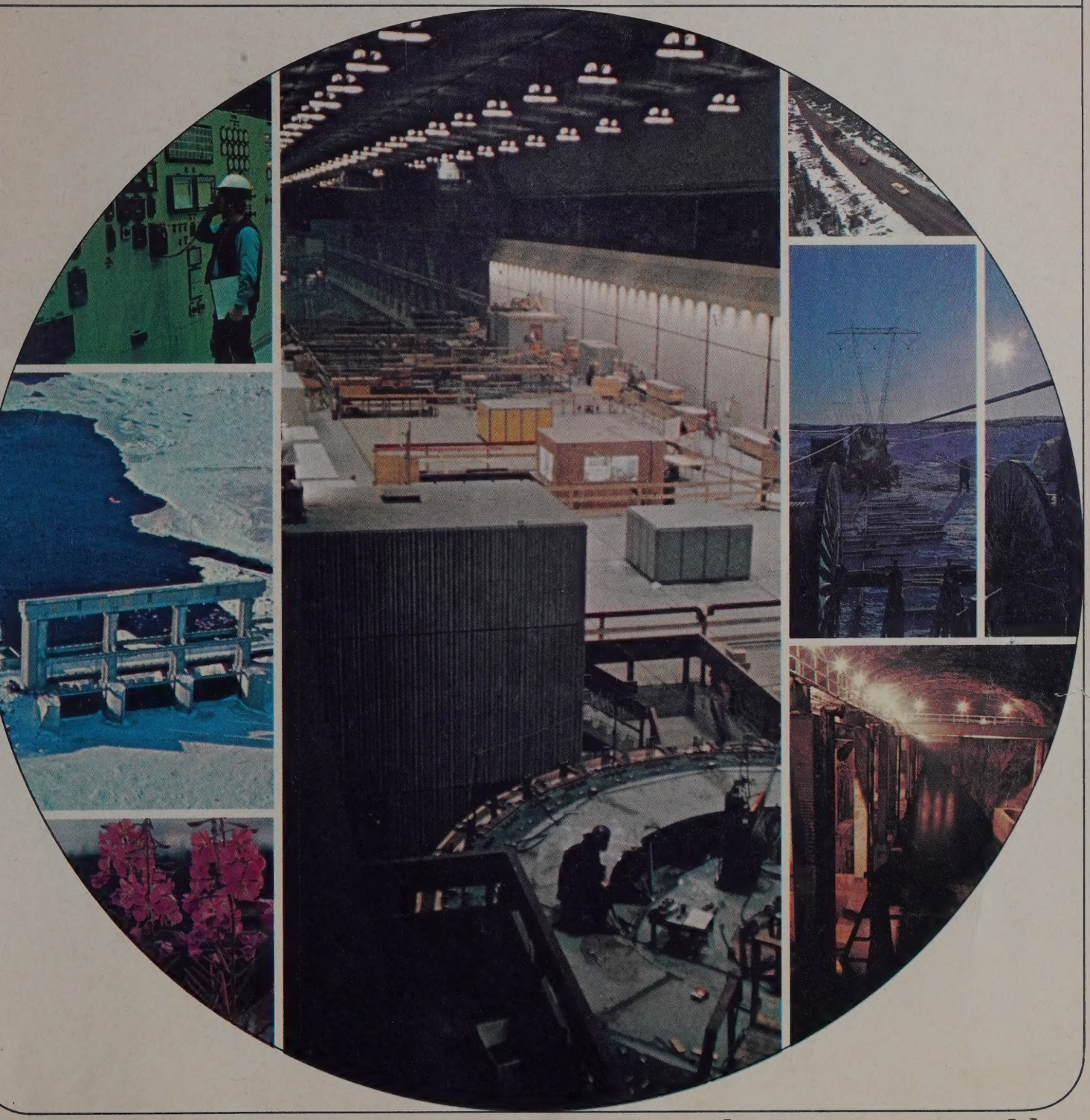
JUNE 16, 1972...

# POWER

## MAKES HISTORY AT CHURCHILL FALLS



Largest Single-Site Source of Power in the Western World.

Editorial material for this Financial Post June 17, advertising supplement supplied by Churchill Falls (Labrador) Corporation Limited

CHURCHILL FALLS
(LABRADOR) CORPORATION LIMITED

ONE OF THE Brinco COMPANIES

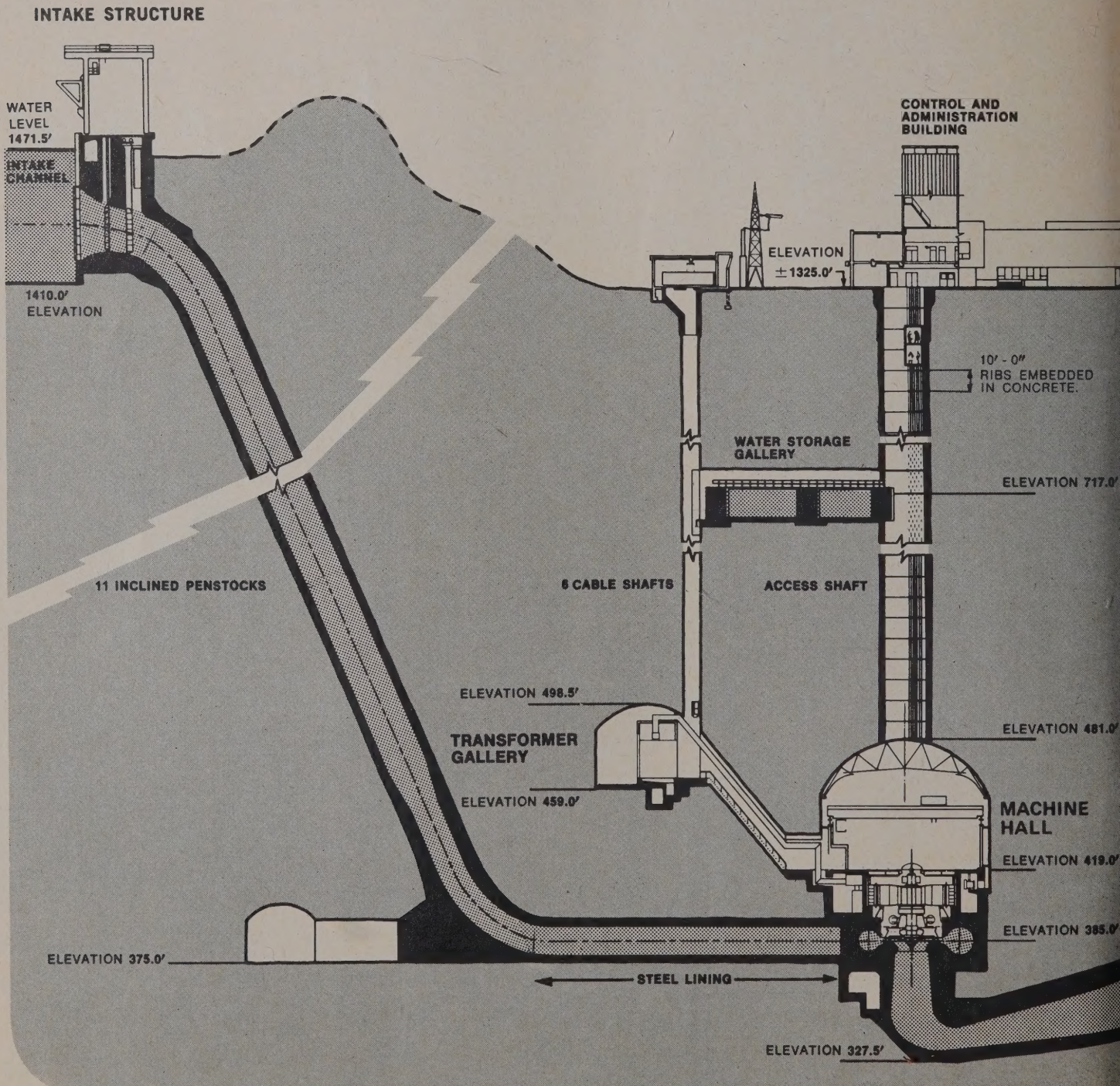
# A new day dawns for Labrador

CHURCHILL FALLS
(LABRADOR) CORPORATION LIMITED

ONE OF THE Brinco COMPANIES

# Power for the people of Canada

# LARGEST SINGLE-SITE HYDRO FACILITY IN THE WESTERN WORLD...



| | |
|---|---|
| **Generating Units:** | |
| Number | 11 |
| Rated Output | 475,000 kW |
| **Turbines:** | |
| Rated Net Head | 1,025 feet |
| Rated Output | 648,000 hp |
| Rated Speed | 200 rpm |
| **Generators:** | |
| Rated Capacity | 500,000 kVA |
| Rated Voltage | 15 kV |
| **Penstocks:** | |
| Number | 11 |
| Length (excluding intake transition) | 1,400 feet |
| Internal Diameter | |
| —Concrete Lined | 20 feet |
| —Steel Lined | 14 feet 7 inches |
| **Powerhouse:** | |
| Maximum Length | 972 feet |
| Maximum Width | 81 feet |
| Maximum Height | 154 feet |
| **Surge Chamber:** | |
| Length | 763 feet |
| Width (varies) | 40 to 64 feet |
| Height | 148 feet |
| **Vent Shaft:** | |
| Diameter | 20 feet |
| Depth | 829 feet |
| **Tailrace Tunnels (Unlined):** | |
| Number | 2 |
| Width | 45 feet |
| Height | 60 feet |
| Average Length (each) | 5,550 feet |
| **Transformer Gallery:** | |
| Length | 856 feet |
| Width | 50 feet |
| Height | 39 feet |
| **Cable Shafts:** | |
| Number | 6 |
| Internal Diameter | 7 feet |
| Average Depth | 865 feet |

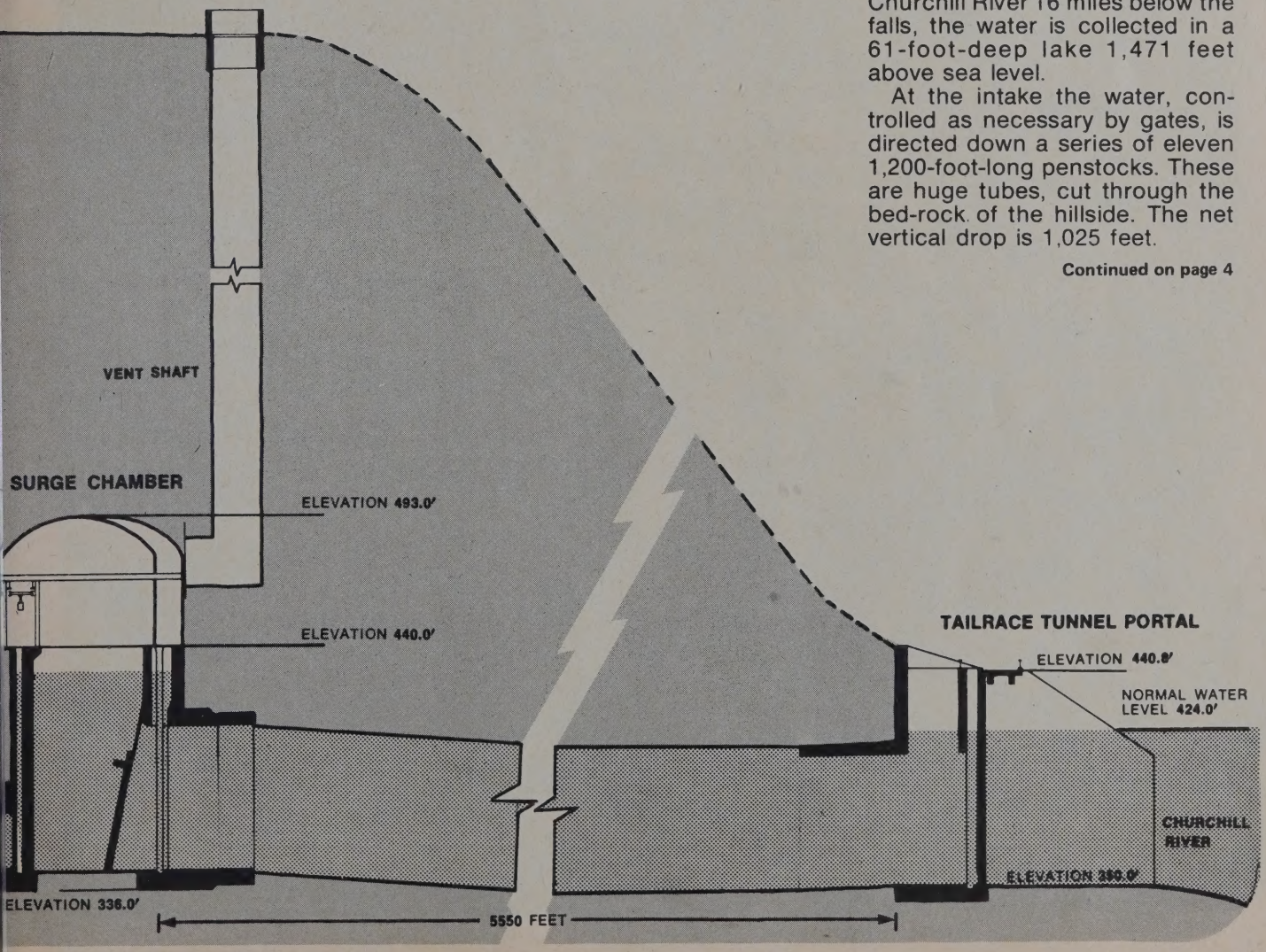
The mighty Churchill River has flowed tumultuously from the central Labrador plateau down to the sea for centuries. Now the torrent is being harnessed to generate more than seven million horsepower, the largest single-site hydro-electric development in the western world. And the job is being done within schedule.

The heart of the huge development — the powerhouse — is awesome in size and its complexity is sometimes difficult for the layman to grasp. In basic terms, the water drops down a hill to turn turbine runners — big water wheels — at the bottom. The turbines are attached to generators, and the spinning generators produce electricity. The vastness of the development is epitomized by the fact that the energy produced is enough to light more than 65 million 60-watt bulbs. This is equivalent to a lightbulb every two feet around the equator.

First element of the powerhouse complex is the intake structure. On a high bank of the Churchill River 16 miles below the falls, the water is collected in a 61-foot-deep lake 1,471 feet above sea level.

At the intake the water, controlled as necessary by gates, is directed down a series of eleven 1,200-foot-long penstocks. These are huge tubes, cut through the bed-rock of the hillside. The net vertical drop is 1,025 feet.

**Continued on page 4**



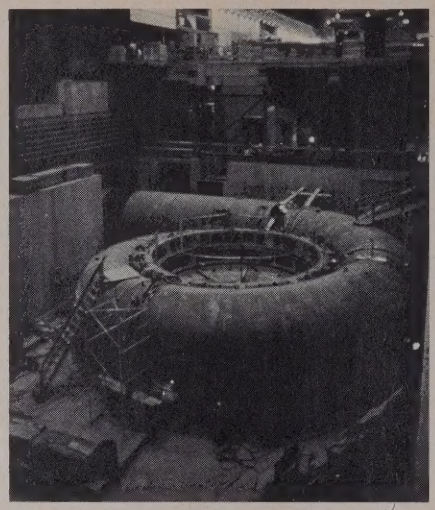
The powerhouse contains 11 turbines, one fed by each penstock. The turbines — vertical shaft Francis type — have a rated capacity of 648,000 horsepower each. The runners weigh about 85 tons apiece.

The turbines in turn drive 11 generators, each with a rated capacity of 500,000 kVA. The generator rotors, each weighing 650 tons, are 30 feet in diameter and turn at a speed of 200 revolutions a minute. The height from the top of each generator to the bottom of each turbine draft tube is about equal to that of a nine-storey building.

Underground next to the powerhouse is a transformer gallery which raises the generated voltage to 230,000 volts from 15,000 volts. The power is then led to the surface through six cable shafts averaging 865 feet in length, where it is again stepped up, this time to 735,000 volts.

After the water has spun the turbines, it passes through a tunnel into a surge chamber, in effect a big tank designed to smooth out any sudden changes in water flow. In normal operation this chamber will contain enough to fill about six million bathtubs.

From the surge chamber the water flows through two one-mile-long tunnels to the Lower Churchill River.



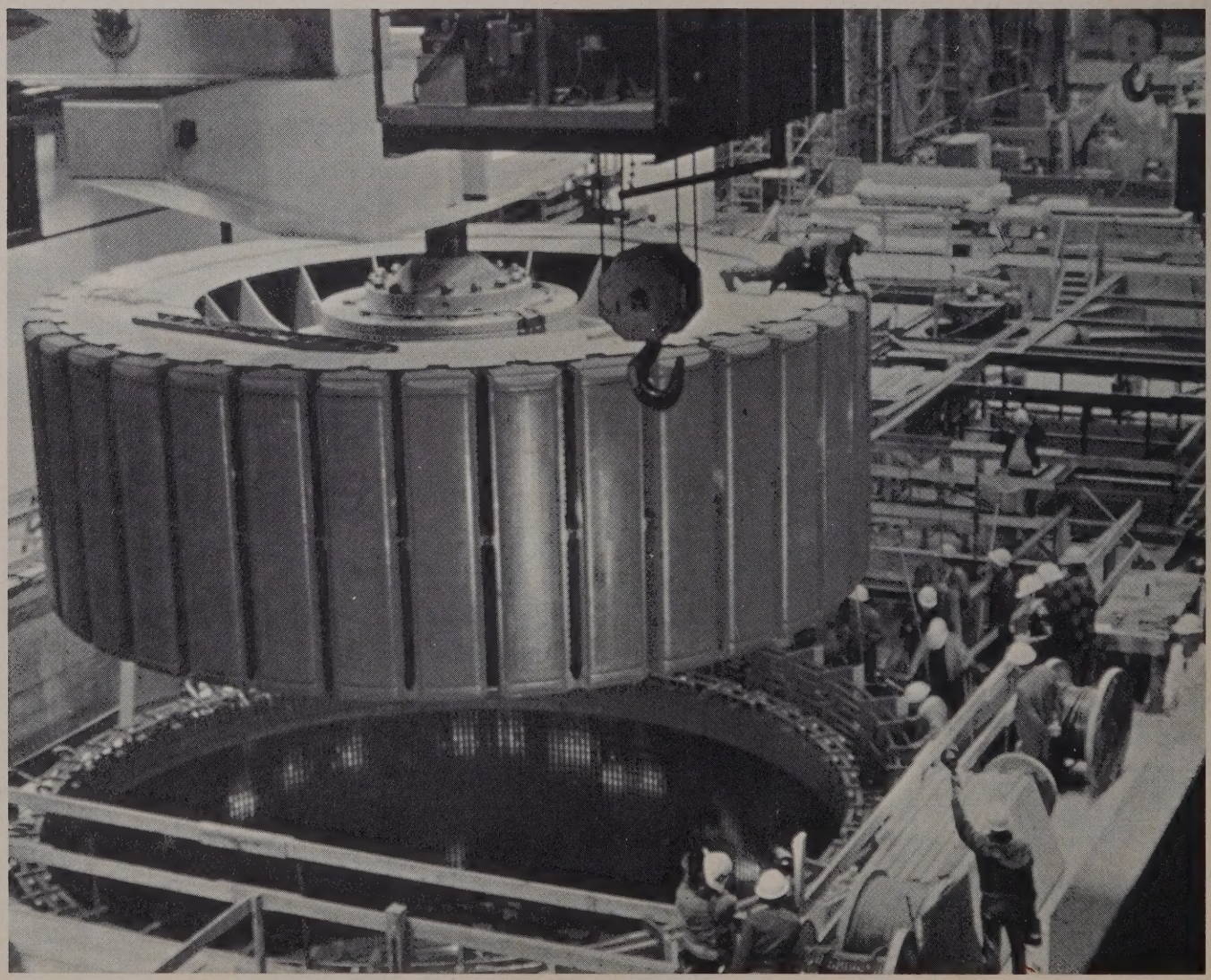
Above: Scroll case being welded into place for turbine-generating Unit 5.

Below: Rotor for Unit 1 being lowered into stator.

Only the control and administration building, the switchyard and the intake structure of the powerhouse complex are above ground. All the rest, including several access tunnels for inspection of underground areas, were carved out of the ancient Precambrian rock of the Canadian Shield. It meant excavation of a total of 2,350,000 cubic yards of rock. At the peak 22,000 tons of rock a day were removed.

After thousands of feet of test borings, detailed geological mapping and laboratory studies of rock specimens, excavation work started on an access tunnel in the autumn of 1967 and finished in July, 1970.

The powerhouse itself — more than the combined length of three football fields — is an astounding chamber. With a maximum length of 972 feet, a maximum width of 81 feet and a maximum height of 154 feet, it is five times larger in volume than the concourse of Montreal's Central Station of the C.N.R.



# No job's too big, no job's too tough.

Not for Bell's 205A's. Not even in the bitter environment of Labrador where Churchill Falls Corporation pilots are flying them on the largest single hydro-electric power development ever undertaken in North America.

At Churchill Falls, Bell's turbine-powered 205A's make the impossible, possible. Like moving men and equipment over the rugged terrain. Getting into places inaccessible by ground travel. Working through the long months of subfreezing weather. And the annual average snowfall of 154 inches.

The 1,400 hp 205A hustles across the turbulent Churchill River with a load of concrete, then shuttles back for more.

All in under five minutes. It strings cables and carries steel for massive transmission towers. It hauls up to 4,000 pounds of cargo internally, 5,000 slung externally. Traveling through the frozen wilderness at 130 mph over a 325 mile range. Carrying 14 passengers and pilot. Safely.

Bell's 205A, the world's most dependable utility helicopter. Helping develop the country for you.

**BELL**
HELICOPTER
OTTAWA 4, ONTARIO
A textron COMPANY


For a demonstration or free illustrated brochure, contact Bell Helicopter Textron Canada Limited, 237-7086, Suite 1400, Varette Building, 130 Albert Street, Ottawa, Ontario, Canada

# A GIANT'S PIE-PLATE

The foundations of the Churchill Falls power project were laid during the past ten million years.

That's when Mother Nature shaped and moulded the land into the configuration which has made the development possible.

As successive glaciers moved across the central Labrador plateau they scooped up soil and carried it as far as what is now the United States. At the same time, they gouged out troughs in Labrador's granite bedrock.

When these glaciers retreated they left the plateau in the shape of a well-worn tin pie plate. The dents eventually filled with water to become a myriad of lakes. The gouges became rivers like the Churchill.

The rim of the pie plate remained more or less intact, making the concept of the Churchill project comparatively straightforward. The engineers built dykes to block gaps around the edge. This allowed the plate to fill to the brim with water. Then a hole was punched in the side, and a power plant built at the point where the water poured through.

After the glaciers retreated the harsh land lay silent for thousands of years. With the coming of man, a few bands of Indians began to traverse the area. But it was a hard frontier, poor in furs compared with some areas further south, and visitors were few.

The first white man to see Churchill Falls was Hudson's Bay Company trader John McLean. He traveled from Fort Chimo up the river in 1839. He was impressed with the grandeur of the falls, but didn't think they were as spectacular as Niagara.

A later visit was made by two students from Bowdoin College in Maine. Through inexperience they nearly lost their lives in the exploit, but they left their stamp by naming the canyon below the falls after their alma mater.

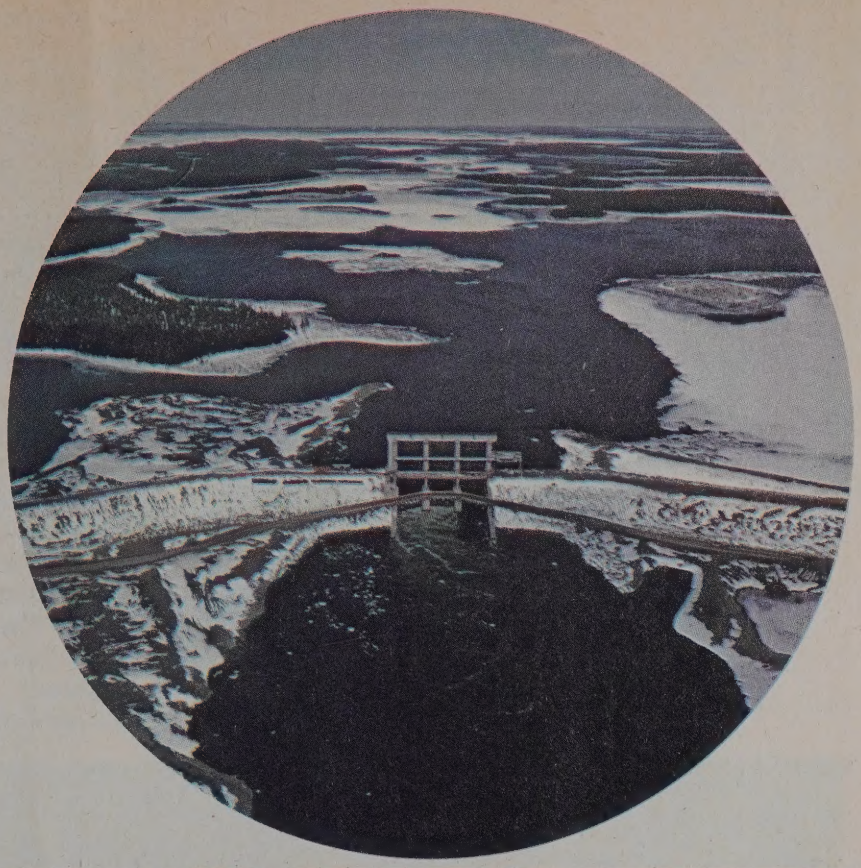
From that time on the occasional scientist, explorer or curious traveler visited the falls area. All were impressed by the majesty of the torrent, and a few dreamed of harnessing it. But there were more accessible sites still untapped, and the demand for energy hadn't grown to anything like its present proportions. But twenty years ago, the situation began to change.

In 1953 Brinco Limited (then British Newfoundland Corporation Limited) was formed to explore and develop the water power and other resources of the Province of Newfoundland and Labrador.

Exploitation of the iron deposits in Western Labrador by other interests led to the construction of a railroad inland in 1954. By 1957 Brinco had roughed out the concept of the present development and built a 105-mile access road from the railway line to the falls. In 1958 a power development company, now known as Churchill Falls (Labrador) Corporation Ltd. (CFLCo) was incorporated, as a Brinco subsidiary, to develop the drainage basin of the Upper Churchill river. By 1960 the initial limited energy development was born with the installation of a 120,000 horsepower plant to serve the iron mines.

Engineering and other feasibility studies continued over the next few years. Advances in the technology of high-voltage transmission and the growing demand for power culminated in an agreement in principal between CFLCo and the Hydro-Electric Power Commission of Quebec (Hydro-Quebec). The two signed a letter of intent in 1966 by which Hydro-Quebec agreed to purchase virtually all the output of a Churchill Falls project.

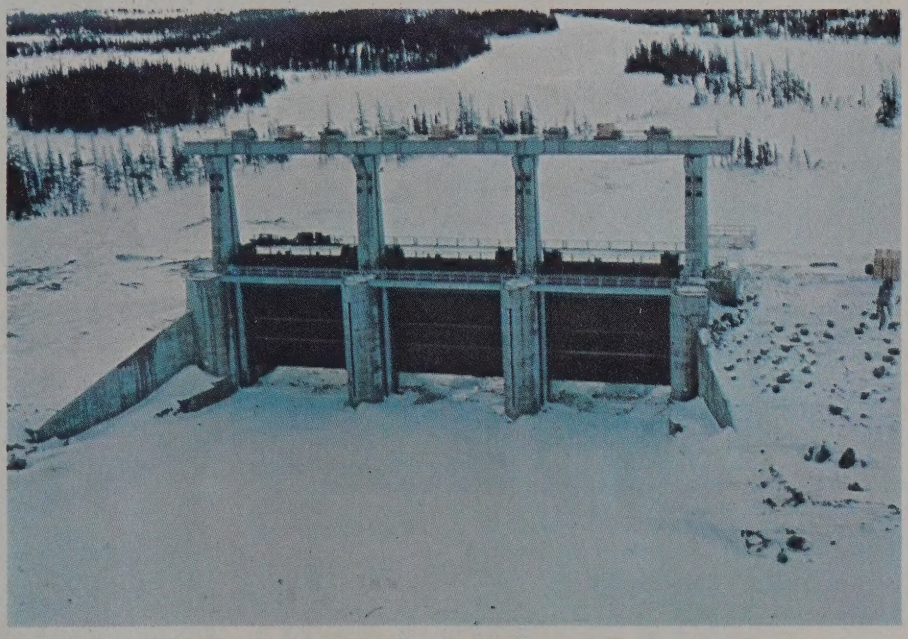
Thus today's gigantic development was born.



Right: **LOBSTICK**, the largest control structure, has three gates 45 feet wide by 63 feet high, and each weighing 210 tons. Its total discharge capacity is 230,000 cubic feet per second.

Below: **WHITEFISH** control structure needed 25,000 cubic yards of concrete and has a discharge capacity of 100,000 cubic feet per second.

Bottom: **JACOPIE SPILLWAY,** completed early in 1971, has four gates, each measuring 49 feet high by 45 feet wide by 4 feet thick, and each weighing about 150 tons. The structure has a discharge capacity of 165,000 cubic feet per second.



Above: **FOREBAY SPILLWAY** required 18,000 cubic yards on concrete and has a discharge capacity of 105,000 cubic feet per second.

**Continued on page 30**

The energy generated by the Churchill Falls plant starts on its journey to the customers from a switchyard covering 62 acres situated 1,000 feet atop the underground powerhouse. The switchyard is an intricate network of wire, transformers, switches, circuit breakers and other control devices.

The principal customer, Hydro-Québec, is taking delivery near Seahorse, 126 miles from the generating site. Ensuring regular and reliable transmission has been a major phase of the whole project.

Selection of the route for the power lines over the rugged Labrador terrain called for comprehensive and meticulous study.

First a five-mile-wide corridor was chosen, using high-altitude aerial photographs. Then a 3,000-foot-wide strip was selected from the wider corridor and soil types determined, again by aerial photography.

Photogrammetric maps were made and a computer program carried out to determine tower positions. All this data was carefully checked by ground surveys before the route and positions were finally established.

The right-of-way averages 710 feet wide. There are three to four towers to the mile over its length. Consideration of soil and climatic conditions led to a decision to use V-type guyed towers almost throughout.

The V-type towers range from 125 to 165 feet in height and weigh up to 37,000 pounds each.

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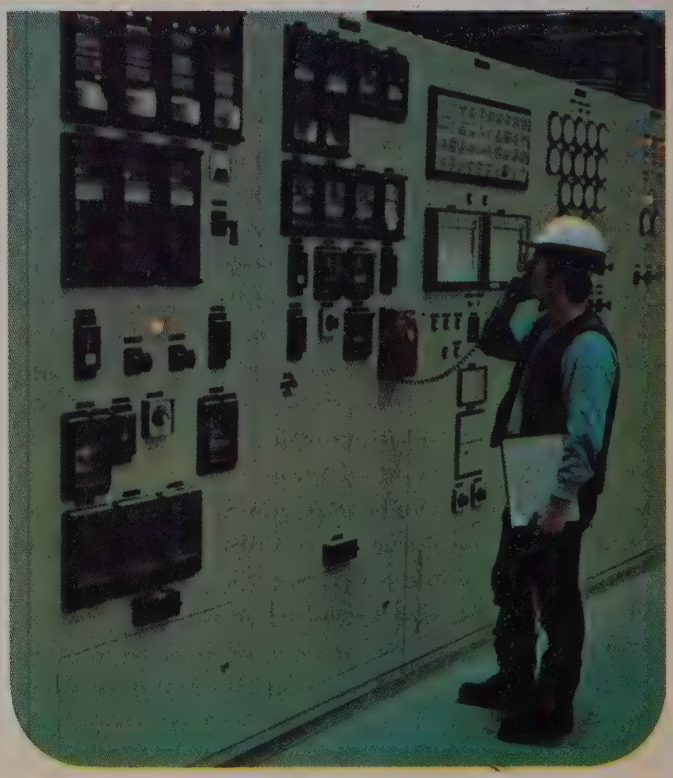

Top: About 400 V-type guyed towers ranging in height from 125 to 165 feet will be required for each of the three 124-mile 735-volt lines from the Churchill Falls plant to the point of delivery to Hydro-Quebec.
Centre: Night view of the switchyard where most of the power from the underground powerhouse is transformed from 230,000 volts to 735,000 volts.
Bottom: Engineers keep a close watch on the control panels during preliminary testing of the first of the 11 turbine-generators to be installed in the Churchill Falls plant. Two of the three 735,000 volt transmission lines linking Churchill Falls and the Hydro-Quebec network have now been successfully energized.

# POWER LINE TOWERS WEIGH UP TO 170 TONS

# Getting to Churchill Falls isn't easy.

Not when you're taking dozens of computers. Moving hundreds of families. Shipping office, hotel and school furniture. Plus precision hospital equipment.

Delays could be costly. Equipment damage could throw off the timing of the entire project. That's a problem to grey the hair of any Traffic Manager.

And that's exactly why Churchill Falls (Labrador) Corporation Ltd. put in a call to Mayflower's largest Canadian agent, Lakeshore Movers & Warehousing (Can.) Ltd.

With millions of dollars at stake, they chose Lakeshore Mayflower. Mover with long experience in the North. Mover with 45 years experience in handling the difficult, the unusual.

Lakeshore got moving. Planning each move. Checking deadlines. Anticipating tricky loading problems and bad road conditions. Being ready with special vans to pamper the delicate electronic equipment. Getting the job done.

Results? Moves that came off without a hitch. No last-minute mix-ups.

And most importantly, the vital Churchill Falls development project comes on stream, on schedule.

The Churchill Falls story is another example of how Mayflower handles your moves as if our next job depended on it.

Because it does. **It doesn't take computers to figure who to call for your next move.**


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LAKESHORE MOVERS & WAREHOUSING
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AERO MAYFLOWER TRANSIT COMPANY, LTD., TORONTO, CANADA

from page 8

Each of three transmission lines will carry 735,000 volts in three bundles of conductors. Two other circuits, each 24 miles long and carrying 230,000 volts, are being built from Churchill Falls to the existing Twin Falls installation.

From Twin Falls other lines feed the iron ore developments at Wabush and Labrador City. These two circuits will enable Churchill Falls to supply additional power to the developments.

The contract between Churchill Falls (Labrador) Corporation and Hydro-Québec called for the first commercial delivery of power May 1 of this year. However, the first two of the 11 generating units began feeding the Quebec system in December of 1971. Four turbine-generator units are expected to be in operation by the end of this year, and all will be in service during 1975, instead of 1976 as originally planned.

Footings for the third 735,000-volt transmission line can be seen at right of 710-foot right-of-way. First line was energized in late 1971. Second line, in centre, is 99 percent completed while third line is scheduled for completion June 1, 1973.

# 196-FOOT TRANSPORTER CARRIES 224 TONS

Included in the cost of building the Churchill Falls power plant is quite a freight bill. It will amount to about $40 million.

By the time the job is finished more than 650,000 tons of material and equipment will have been moved from the sources of supply to the once-remote central Labrador site.

Instead of having scores of contractors pouring material directly into Churchill Falls by their own transport methods, four designated consolidation terminals were established. These are St. John's, Montreal, Sept-Iles and in winter, Quebec City. The suppliers deliver to one of these points, and Churchill Falls (Labrador) Corporation (CFLCo) takes over from there.

Three quarters of all the freight comes through Montreal. From there the goods and materials normally go 525 miles by ship to Sept-Iles, where they are transferred to the Quebec North Shore & Labrador Railway. A 286-mile rail journey follows, to Esker, where the shipments are again transferred, this time to highway trucks. From Esker it is 113 miles by road to the main camp.

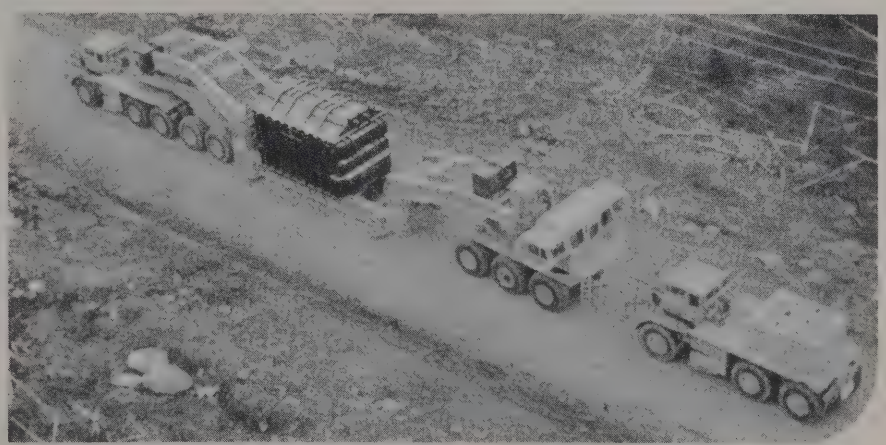
Largest single items to be transported are 29 transformers which weigh between 160 and 224 tons each. A 250-ton dockside crane and a special railway car are necessary to move them from Sept-Iles to Esker.

A huge road transporter, specially designed and built, carried each one from there to its final destination at the powerhouse site.

The transporter is 196 feet long and has 22 wheels. There are two 700 horsepower six-wheel-drive tractor trucks, one in front and one at the rear.

The 113-mile trip along the road takes about three days, at speeds of between two and three miles an hour with frequent stops for inspection and refuelling.

The tires are seven feet three inches high and weigh 1,768 pounds each. Tire pressure is 80 pounds per square inch.



The tractors consume about 15 gallons of diesel fuel a mile, or about 45 gallons an hour. Each unit has two 200-gallon fuel tanks. For night operation each unit has eight headlights, 12 floodlights and two spotlights for a total of 182,000 candlepower.

Despite its huge size and slow speed, the transporter doesn't affect normal traffic on the road. Turnouts have been built along the road to allow faster traffic to pass when the big machine stops for fuel or routine inspection.

Delivery of the transformers and thousands of other items on schedule required careful planning.

To process the vast amount of transportation data and keep management informed of potential problem areas, a computerized transportation information system was devised. One of the daily reports produced tells the location of every piece of freight in the system. Another lists shipments by individual contractors, to inform jobsite receivers when materials are due to arrive.

Air transport, primarily for personnel, is through a modern airport four miles from the townsite. A 5,500-foot runway permits service by big jet aircraft.

Air transport came to the rescue during the summer of 1969. Labor difficulties in the iron mining industry resulted in the disruption of traffic on the Quebec North Shore & Labrador Railway. The effect could have been critical to the over-all schedule. But a massive airlift was introduced, carrying 15,000 tons of all types of construction material and supplies to the Churchill Falls airport.

# OPERATING STAFF
## Woodsman/Electronic Skills Required

Some of the younger children now at Churchill Falls could grow up, be educated, work and retire in the community.

The possibility exists because the plant must be operated and maintained by a relatively small permanent staff over the life of the power contract with Hydro-Québec, a span of 65 years. Comprehensive living facilities, therefore, were built into the townsite which will accommodate the operations staff once construction has been completed.

Operations engineers and supervisors began as early as 1970 to scrutinize the design, manufacture and installation of the plant's components so they could train operators, technicians and others.

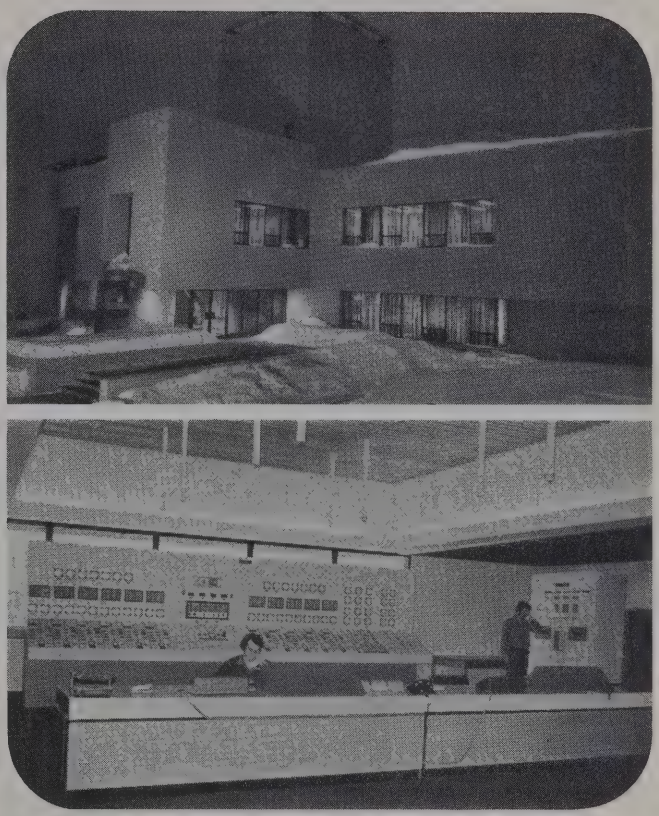
Training, of course, is a long-term requirement to continually upgrade the technical capabilities of the staff. On-site class instruction, correspondence courses and government approved apprenticeship programs are used in addition to on-the-job training.

The inherent nature of a hydro-electric plant requires a staff made up of workers skilled in a wide variety of trades. It needs men who are as adept in the bush as pioneer trappers and knowledgeable about sophisticated solid state electronic communications systems. Both skills are required in the operation of the huge main reservoir. Continual surveillance of 40 miles of dykes is needed. A network of snow sampling, stream gauging and meteorological stations must be checked every couple of weeks to provide data for long-term planning of plant generation.

The seven reservoir control structures, situated up to 65 miles from the powerhouse, are operated and monitored by systems requiring electronic technicians. These technicians also maintain the tropospheric scatter microwave radio link with Hydro-Québec which carries voice, telemetering, control and relay signals. They maintain also the powerline carrier radio relay links, other mobile radio and telephone communications, and powerhouse electronic monitoring and control equipment including a computer.

Machinists, welders and fitters will dismantle completely and overhaul the 11 huge turbine generating units at the rate of one or more a year, and then reassemble them, aligning the 800 tons of rotating parts to within a few thousands of an inch.

In the powerhouse there are thousands of cables interconnecting to the control and protective relay panels, dozens of extra-high voltage circuit breakers, metering transformers and disconnecting switches. These contain a myriad of relays which will detect and isolate faults in the system in a tenth of a second, and transducers, meters and recorders which provide instrumentation for the plant's operation and measure the power sold. Servicing all this equipment requires specially trained electricians and instrument technicians.



Top: The control and administration building, located in the switchyard: the nerve centre of the power complex.

Above: Control room inside control and administration building where computerized monitoring of electrical production is maintained.

The 378 miles of 735,000-volt transmission lines, working at among the highest operating voltages in the world, carry more than 4,500 miles of conductor supported on 1,230 towers and hung by some 450,000 insulators. Linemen travelling in helicopters and muskeg tractors must use exacting techniques to remedy faults while the lines are in service.

Great advances have been made in automating hydro-electric plants. A process control computer is used at Churchill Falls to monitor the status of 2,000 alarm switches every second, and type a description of a problem which might occur. In addition, it reads 160 temperatures, pressures and electrical quantities, compares them to preset values, and automatically prints out information about any dangerous trend.

But it is people who must read the printouts, and be ready if action beyond the capabilities of the machines is necessary. These people, and the specialists in the other fields, will comprise the tightly-knit and highly skilled operating staff around the clock until well into the 21st century.

# 21,000 Canadians own BRINCO STOCK

A group of seven British companies banded together in 1953 to form British Newfoundland Corporation Limited — now Brinco Limited. Today the company has about 21,000 resident Canadian shareholders from coast to coast.

The seven original companies were N. M. Rothschild & Sons; Anglo American Corporation of South Africa, Ltd.; Anglo-Newfoundland Development Company Ltd.; Bowater Paper Corporation Ltd.; English Electric Company Ltd.; Frobisher Ltd., and Rio Tinto Company Ltd.

In return for guaranteeing to actively pursue the development of the natural resources of Newfoundland, Brinco, as it is now known, received options and rights on much of the mineral, forest and hydraulic wealth of the province.

These rights included the drainage basin of the upper Churchill (then called the Hamilton) river. In 1958 a subsidiary company, now known as Churchill Falls (Labrador) Corporation Ltd., (CFLCo) was set up to facilitate a development.

The two companies have changed substantially over the years, expanding and reorganizing as the realization of a Churchill development came closer and the concept grew in size and scope.

Canadian participation in Brinco was extended in 1965 when stock which had been traded over-the-counter, was listed on the Montreal Stock Exchange. In 1968 it was listed also on the Toronto market.

The 21,000 resident Canadian shareholders own about 40 percent of the shares. About 14,000 of them own less than $1,000 worth of stock.

In 1968, with the call for additional equity contributions for the Churchill Falls project and for more funds for mining exploration, the financial structure was again revised. Rio Tinto-Zinc Corporation of Britain and Bethlehem Steel Corporation of the United States agreed to provide more than $40 million to Brinco to buy treasury shares, and to underwrite a rights issue to existing shareholders.

Through a Canadian holding company, Thornwood Investments Ltd., the two own 49 percent of the shares in Brinco. Rio Tinto-Zinc is the majority shareholder in Thornwood Investments, and besides has about 10 percent of the outstanding Brinco shares in its own right, giving it effective control.

Brinco is the majority shareholder in CFLCo, with 57 percent of the stock. The Quebec Hydro-Electric Commission owns 34 percent, and the remaining 9 percent is owned by the Province of Newfoundland and Labrador.

British Newfoundland Exploration Limited (Brinex), the mineral exploration and development arm, set up in 1955, is a wholly-owned subsidiary of Brinco.

Twin Falls Power Corporation Limited was established for initial power development of the Churchill drainage basin to supply energy to the iron mines in Western Labrador. CFLCo holds two thirds of the voting control of this company, and one third of the equity. The other two thirds of the equity are held by Wabush Iron Company Ltd. and Iron Ore Company of Canada.

The estimated cost of the Churchill Falls development was $936 million.

Of this huge sum, the shareholders provided $83 million in equity capital. There were two series of mortgage bonds. One, for $500 million, was placed in the United States and was then believed to be the largest single bond issue ever arranged on Wall Street by an investor-owned company. Another $50 million in bonds was sold in Canada. There was a general mortgage issue of $100 million.

A group of Canadian banks got together to provide $150 million in standby credit. This was believed to be the largest single bank financing venture in Canadian history.

The financing of the scheme was made possible with the signing of a 40-year power contract plus a 25-year renewal agreed to in advance between CFLCo and Hydro-Quebec. It provides for sales of power, beginning this year, valued at approximately $5 billion.

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Where the money comes from

The original capital cost estimate of the Project, which still stands, was $936 million. Financing arranged totalled $1,073 million (Can.) as follows:

| | *Millions* |
|---|---|
| Equity Capital | $ 83 |
| First Mortgage Bonds: | |
| Series A (U.S. $500 million at premium of 7.5% | 540 |
| Series B | 50 |
| General Mortgage Bonds | 100 |
| Retained Earnings during Construction | 150 |
| Standby Bank Credit | 150 |
| | $1,073 |

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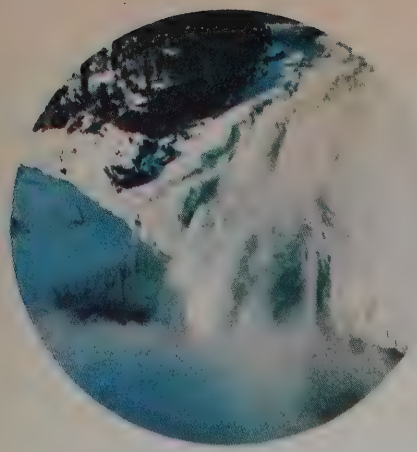


# It takes strong men and strong machines to harness the power of Churchill Falls.

## GMC knows it.

## GMC is there.

Nature put a high price on the potential of Churchill Falls. If the ground isn't frozen rock solid, it's three feet of mud. And the snow and cold combine to make life miserable for men and machines. Despite the great difficulties, Churchill Falls is becoming a reality.

It's now been five years since men and giant earth movers began changing the face of central Labrador. And this year Churchill Falls is producing and selling its first hydro-electric power.


GMC trucks have been there from the start.

Rugged heavy-duty GMC trucks built by General Motors helped move tons of earth. GMC vans delivered crews and supplies deep beneath the earth where the real work of building a hydro-electric plant takes place. Rugged GMC pickups made the rounds on job inspections. And because of the ever present danger that such a job involves, rescue-equipped GMCs stood ready to help in emergencies.

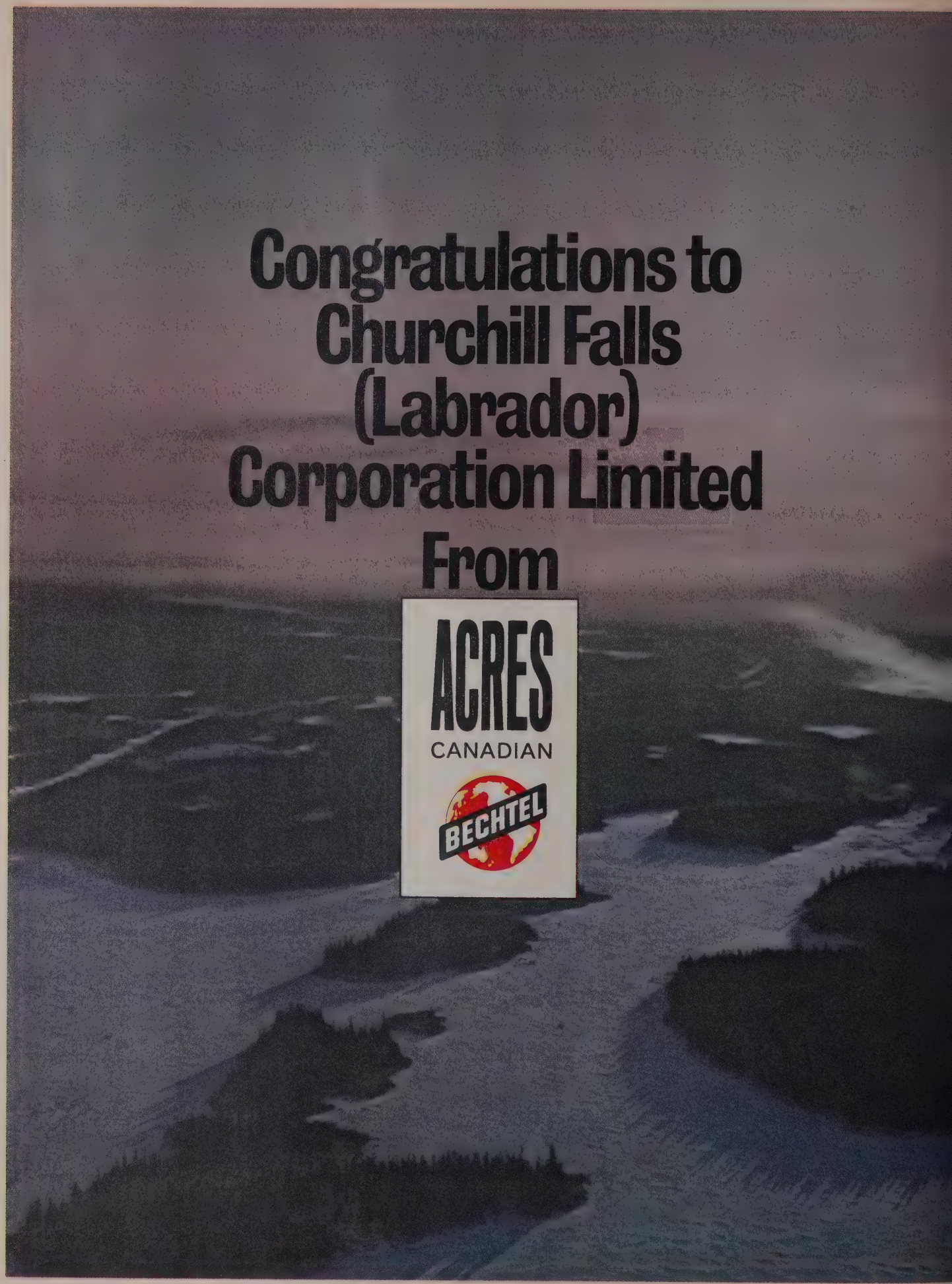
Congratulations to the men who have helped build Churchill Falls hydro-electric plant. It's been a long haul, and there's still a long way to go.

GMC is proud to have been selected to supply trucks and the service the job calls for. And GMC will continue to serve at Churchill Falls...proud to be participating in a venture almost without parallel in the history of heavy construction.

M72-G6

GMC TRUCKS

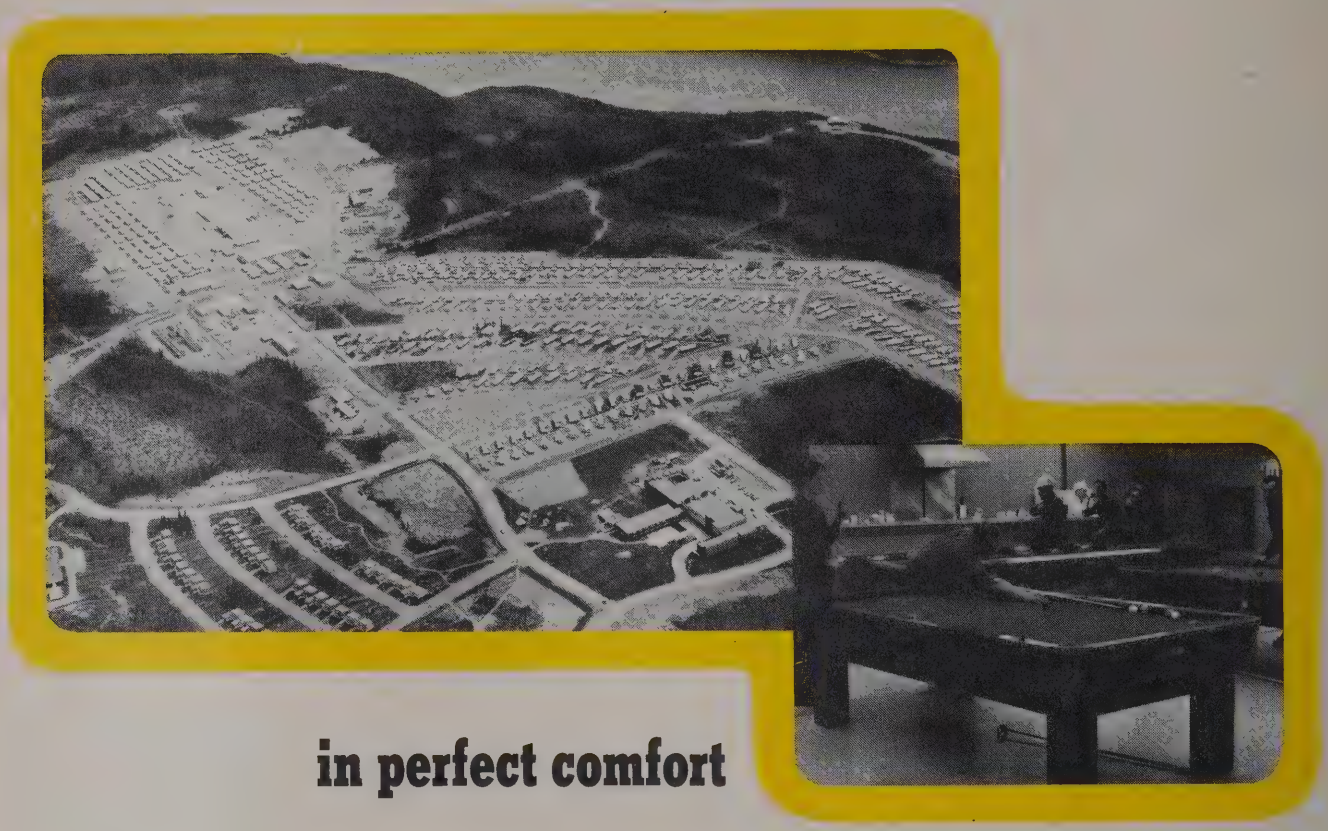
What a difference a name makes


Congratulations to
Churchill Falls
(Labrador)
Corporation Limited
From
ACRES
CANADIAN
BECHTEL

Acres Canadian Bechtel of Churchill Falls (a joint venture between Acres Consulting Services Limited and Canadian Bechtel Limited), is proud of its major role in the development of the largest power project in the western world—the Churchill Falls Hydroelectric Project.

Working in close co-operation with CFL Co. and through the utilization of special Canadian experience in the design and construction management disciplines, this mammoth undertaking has commenced delivering power within the schedule and the capital budget.

# Churchill Falls is hundreds of miles from "civilization". Yet here, through four tough winters, up to 6,000 men worked, ate, slept and relaxed—



## in perfect comfort

# five men or five thousand, ATCO "job-ready" housing can meet any requirement—anywhere—on short notice. If necessary, we'll even fly it in.

ATCO's participation at Churchill Falls is a job we're proud of—but it's far from typical. Most of the jobs we handle involve far fewer men, and not infrequently, the location is even more remote than Churchill Falls. That's why we maintain a huge inventory of job-ready transportable housing, ready for any size order from a single sleeper to a giant "Churchill Falls-type" complex. And it doesn't matter to us where the job is located; if you can drive a truck to the site, or land a plane or helicopter near it, we'll get the buildings there on time. Lease or purchase—it's up to you.

ATCO quality features make our job-ready units much more than four walls and a roof, do much more to maintain crew morale. Ask for detailed specifications, and lease or purchase rates from:

ATCO (EASTERN) LTD., 555 DOLLARD AVE., LASALLE, QUE. TEL.: (514) 363-4430.

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# KEEPING DELICATE BALANCE OF Environment

Jacques Cartier, sailing past the coast of Labrador in 1534, described what he saw as "the land God gave to Cain."

Since that time other explorers and visitors have called it barren, rugged, rocky, harsh and dangerous. But even in this sombre land nature has provided dozens of varieties of wild life.

**Continued on page 20**

from page 19

The flora and fauna lead a precarious, delicately-balanced existence. When this balance is upset, by man or natural causes, recovery can be immensely slower and more difficult than in warmer climates.

In the construction of the vast Churchill Falls development man has conquered the terrain, but not at the expense of upsetting the delicate balance of the environment.

The development has naturally had some effect. Hundreds of square miles have gone to create a reservoir larger than Prince Edward Island.

But from the earliest days of construction Brinco has been sensitive to Nature's work, and on guard against disturbing it unnecessarily.

Larger animals inhabiting the central Labrador plateau include black bear, caribou, wolves and moose. Birdlife includes Canada geese, spruce grouse, yellowlegs, teal, bluejays, blackbirds and the occasional bald eagle and osprey.

Much of the land area is forested with scrub black spruce, little of it of any commercial value. Lichens and mosses, including the widespread caribou moss of the northland, provide the ground cover. The fireweed and goldenrod, provide a sprinkling of color to the landscape.

With literally thousands of streams, lakes and small ponds, it isn't surprising that the area provides good fishing. There are trout — brook, red and grey, landlocked salmon known as ouananiche, as well as pike and other coarse fish.

Such an environment evolved over thousands of years. Thoughtless action could damage it irreparably in as many days.

One of the first precautionary steps Brinco took was to study the effect the power development would have downstream on the Churchill river, which flows eastward from the Labrador Plateau into the Atlantic Ocean. These studies determined that the planned changes would be beneficial.

In the past some of the settlements around the mouth of the river had been disturbed by seasonal variations in water levels as the river rose in Spring and wet periods, and dropped in Autumn. Regulation of the flow through the powerhouse will smooth it out and help overcome a long-standing problem of erosion at the river mouth.

Then there was the creation of the huge man-made lake known as the Smallwood reservoir. A number of potentially harmful effects of inundation of such a large area had to be examined.

In some parts of the world the building of such reservoirs has created seismic effects. Careful investigations showed there was no such danger in this case.

There was the question of mineral resources. Was Brinco covering up metal deposits? Geologists went over the area very carefully, but no mineralization of commercial value was discovered.

Much of the land which was to make up the reservoir was already covered by water. But what of the rest? Surveys showed that the quantity of merchantable wood in the territory was too small to be economically harvested. Only about two percent of the area contained trees over 30 feet high. The balance was made up of 65 percent scrub woods, four percent barren land, nine percent burned-over areas, and 20 percent bog.

Any flooding of large land areas is likely to create problems for wildlife, and the Smallwood reservoir was no exception. To ameliorate the problems, the reservoir is being filled over a period of three years, whereas the job could be done in one.

Biologists and other wildlife specialists retained by Brinco carried out careful studies. The gist of the findings was that some crowding will naturally result and that losses will occur among small animals. However, no species will face extinction. Larger animals such as black bears should have no difficulty in relocating, the study found. In any case, Brinco is continuing to keep an eye on the flooded areas, and go to the rescue of any larger animals which appear to be in trouble.

In studying the effects on fish the scientists had the benefit of statistics covering another large

reservoir in the area, Ossokmanuan, which was established 10 years ago to meet the needs of Brinco's Twin Falls plant. Flooding in this region tends to increase, it was found, both the volume and concentration of microorganisms beneficial to fish life. The fishing should be even better than before, therefore, in the enlarged water area which will make up the new reservoir.

Brinco has welcomed cooperation from government wildlife and fisheries services, and encouraged ecological investigations by outside agencies. In all, it has sought to ensure that despite man's intrusion into the age-old land, the area will remain close to the way Nature made it.

# POWER, FROM GENERATION TO DELIVERY...

The interconnecting transmission lines extend 126 miles from the powerhouse in Labrador to the point where Hydro-Québec takes delivery of energy, and continue another 256 miles from there to the Manicouagan-Outardes hydro-electric complex where they join Hydro-Québec's existing 735,000-volt lines to Quebec City and Montreal.

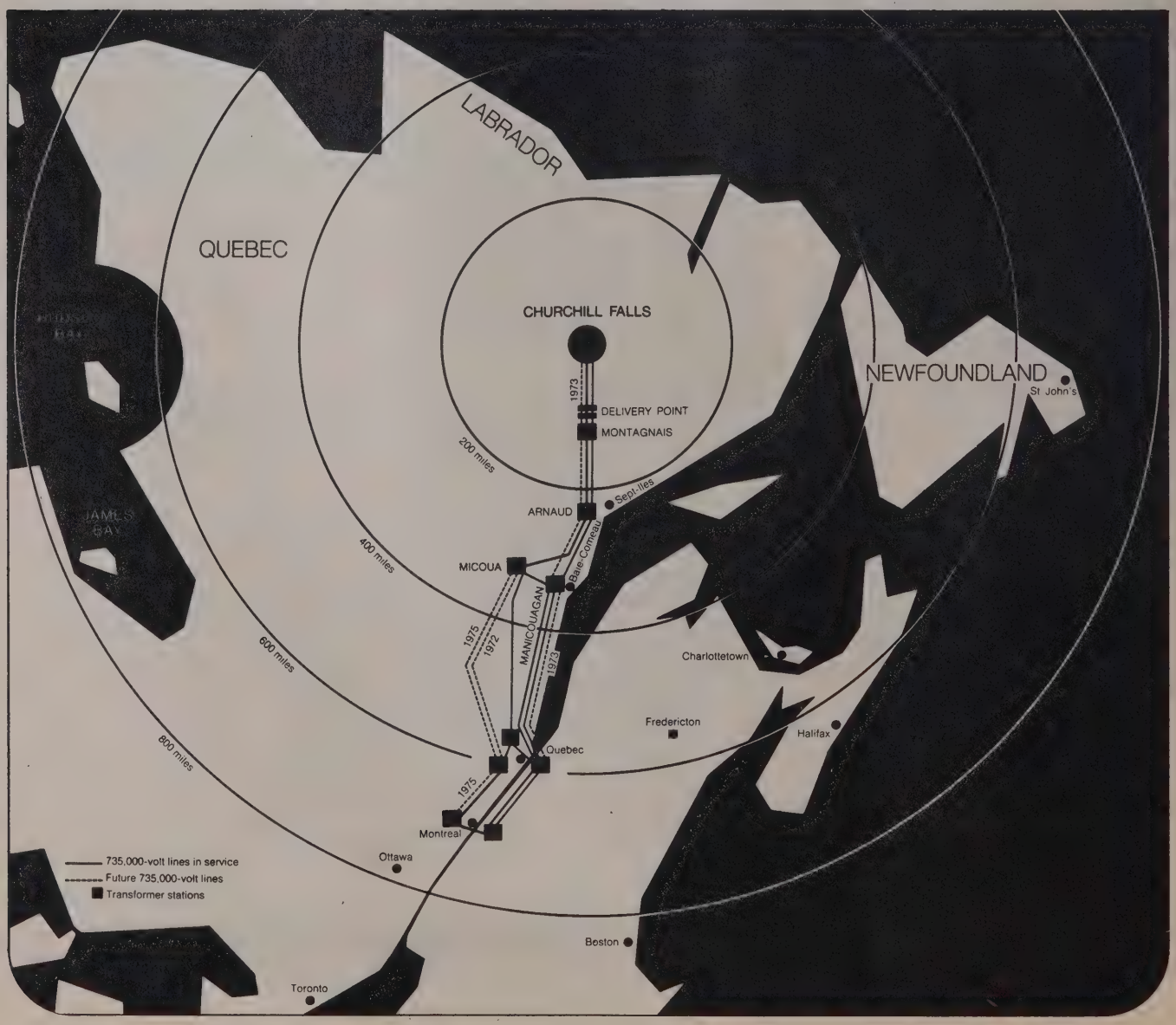
Three interconnecting lines will eventually be required as additional generating units are installed. Two of these lines have been energized. Churchill Falls is building the lines to the delivery point and Hydro-Québec is extending them to the Manicouagan-Outardes complex and also is increasing the number of existing lines from there to Quebec City and Montreal.

The Labrador area of the province of Newfoundland and Labrador (112,826 square miles) is almost three times as large as the Island of Newfoundland (43,359 square miles).

The province as a whole is almost half as large again as the whole of the United Kingdom.

Churchill Falls is 650 miles from St. John's, the capital of Newfoundland. The development is about 700 miles from Montreal, 800 from Boston and about 1,000 from Montreal and New York.

The Churchill Falls development area lies between 53 and 55 degrees north latitude. This is about the same latitude as Manchester or Berlin. The climate at Churchill Falls is more severe, however, because of the cold Labrador current from the Arctic regions which sweeps down the coastline.



# "Let there be light"

In the vast reaches of Labrador lies a gigantic source of power. Fed from thousands of lakes and rivers untouched by the hand of man since time began.

Today, that latent energy is being harnessed in one of the world's greatest hydro-electric projects. A $950 million development undertaken by Churchill Falls (Labrador) Corporation Limited that will have far reaching economic meaning.

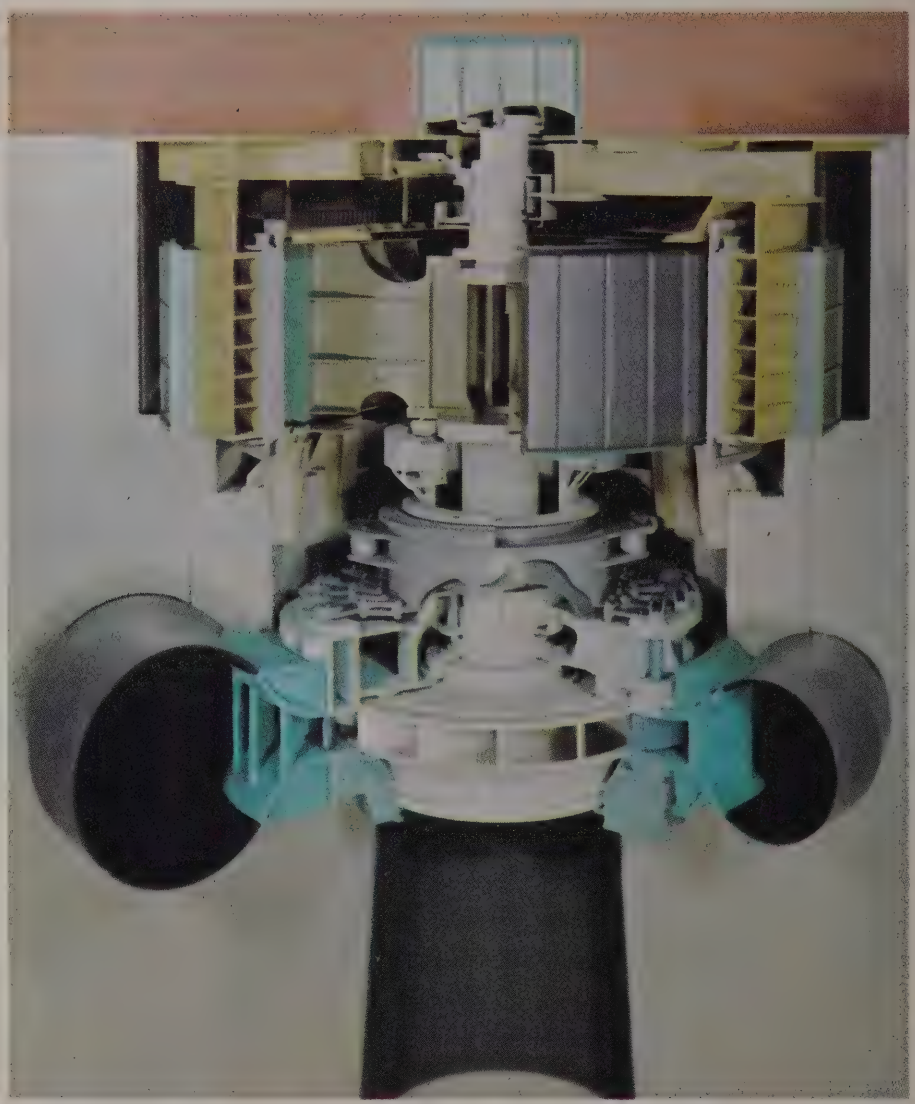
Canada Wire technology helped make the Churchill Falls project a reality. Our role focused on the design, manufacture and installation of over 35,000 feet of unique, oil filled high voltage cable that rises 860 vertical feet from huge underground transformer bays to the switchyard, where power is sent out across Labrador.

Power that is a signal light for great economic growth in eastern Canada.

canada wire

# Partners in Churchill Falls Power

## the Churchill Falls (Machinery) Consortium



Churchill Falls Model of a 475,000 KW turbine generator

*Turbines supplied by:* **MARINE INDUSTRIES LIMITED**
**DOMINION ENGINEERING WORKS LIMITED**

*Generators supplied by:* **MARINE INDUSTRIES LIMITED**
**CANADIAN GENERAL ELECTRIC COMPANY LIMITED**

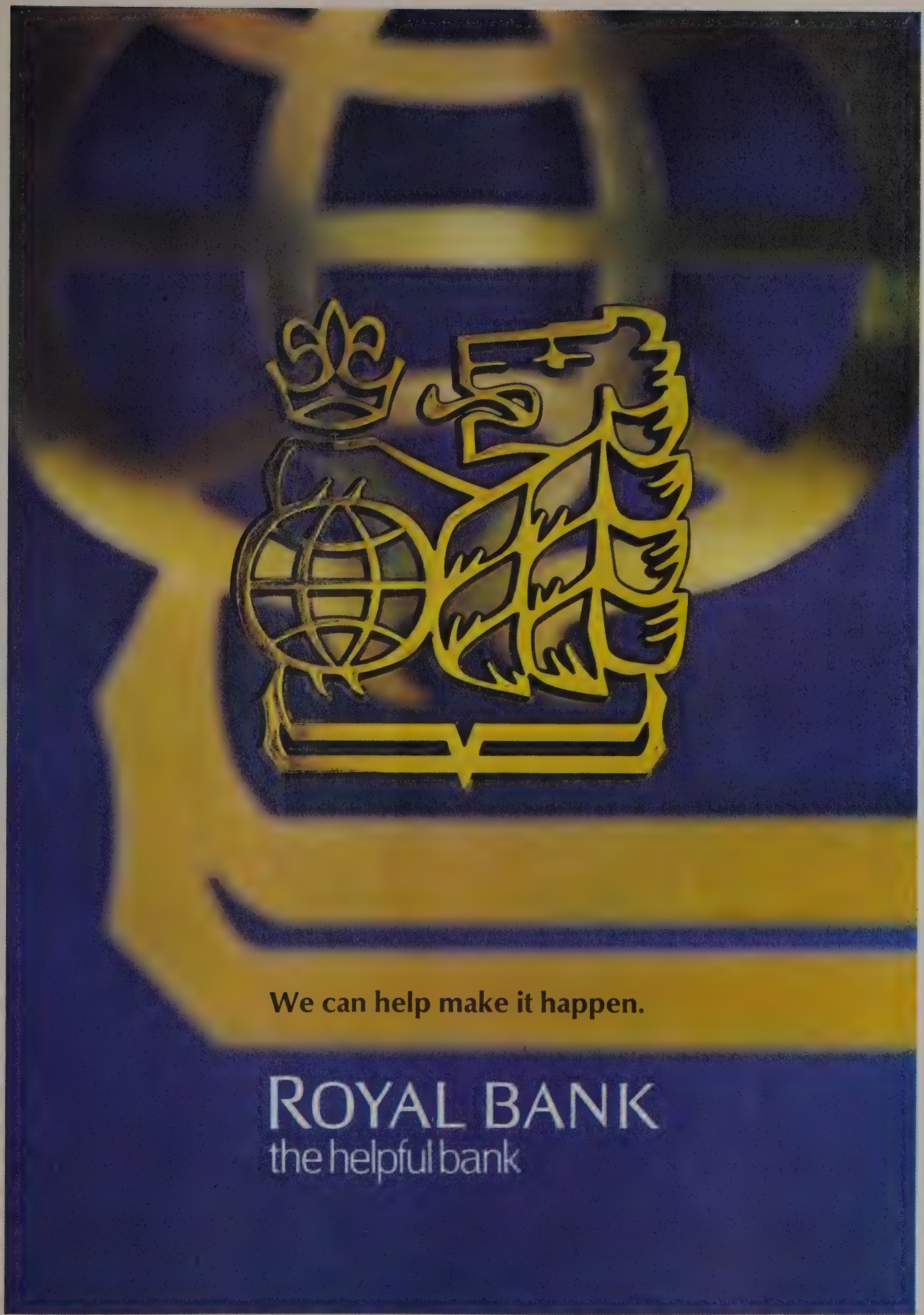

We can help make it happen.
ROYAL BANK
the helpful bank

Photo courtesy of Churchill Falls Labrador (Corporation) Limited

# 735 KV—The big Switch at Churchill Falls

Delta-Star® 735 KV Disconnect Switches were chosen for Churchill Falls Power Development in Labrador. Made at our Woodstock, Ontario plant these switches are among the largest ever installed in Canada.

Delta-Star® 735 KV, one of the H. K. Porter family of fine products.

For information write Electrical Division, H. K. Porter Company (Canada) Limited, Suite 206, 1 Greensboro Drive, Rexdale, Ontario.

**BETTER PRODUCTS BY DESIGN**

PORTER

POWER & DISTRIBUTION TRANSFORMERS • UNDERFLOOR DUCT • CURRENT COLLECTORS • STREET LIGHTING & GENERAL PURPOSE RELAYS.

# ON THE JOB *at Churchill Falls*

The Dominion Bridge contribution to the realization of the Churchill Falls development has been extensive. The company was one of the first contractors on site and since then has supplied equipment and services worth many millions of dollars in the three essential areas of water control, power generation and power distribution. Its skill in design, fabrication, construction services and management was adapted and applied to meet the specific and demanding needs of its customer.

The wide range of Dominion Bridge services available to those responsible for power development projects is based on many years of experience in all parts of Canada and overseas.

## The Dominion Bridge Contribution

***For water control***

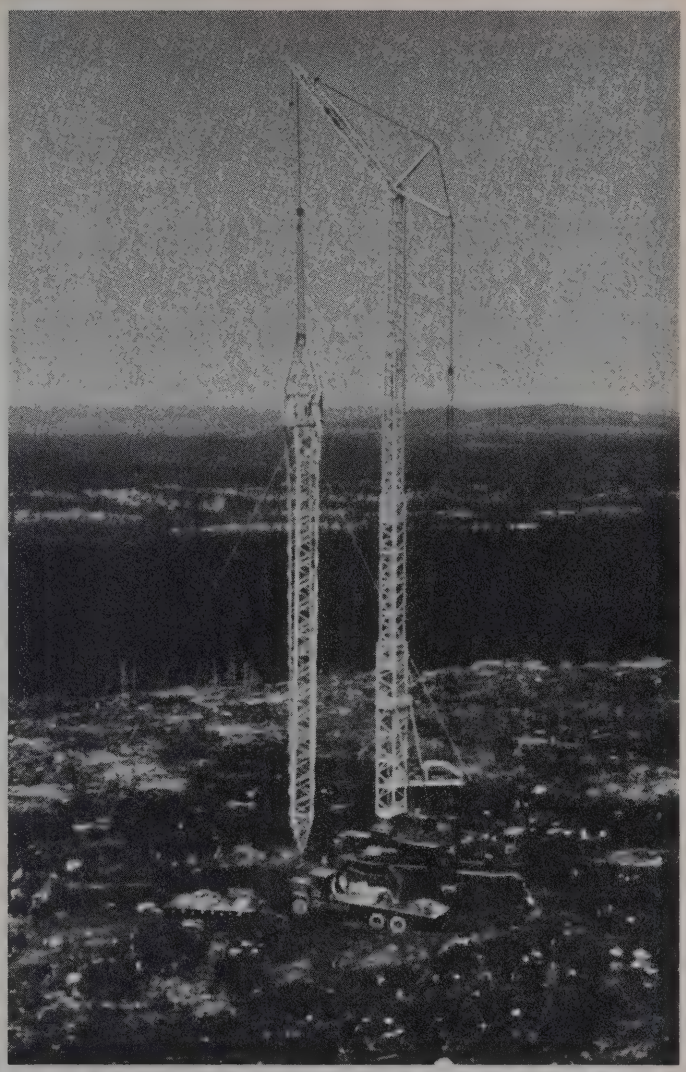
- 11 Intake gates and one 25 ton gantry crane
- 3 Control gates at Lobstick
- 3 Control gates at Whitefish
- 1 250 ton gantry crane at Esker
- 1 20 ton transfer crane at Lobstick

***For the power station***

- 11 140 ft. penstock tunnel liners
- 5 Spiral casings
- 5 Turbines (installation only)
- 2 400 ton power house cranes

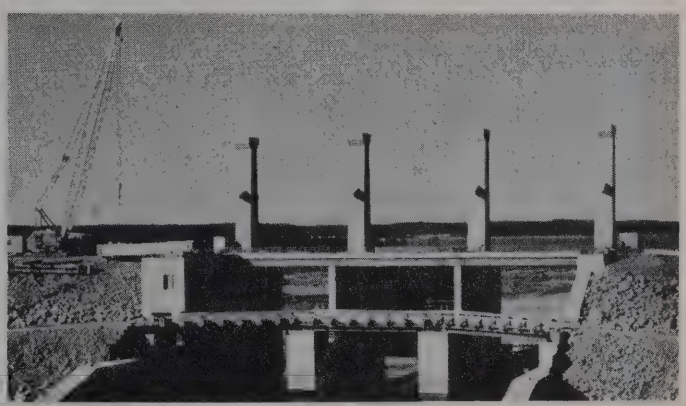
***For the distribution system***

- 2700 tons of steel for the switchyard (erection only)
- 815 Transmission towers (assembly and erection only)



**Raising a tower** on the 126 mile twin line with a special mobile crane built to Dominion Bridge specifications. Fabricated steel was delivered to D.B. crews who assembled the components and then raised the finished tower to its vertical position.

**Installing a steel penstock tunnel liner.** One of eleven fabricated, and put in place by Dominion Bridge construction crews. Each liner is about 14 feet in diameter and 140 feet in length.



**Three 240 ton gates** designed, built and put in place by Dominion Bridge are part of this Lobstick control structure. These gates are among the largest built anywhere.

Dominion Bridge Company, Limited

24 PLANTS IN NORTH AMERICA

332-B

The force to drive the 11 turbines in the Churchill Falls powerhouse will come from the world's third largest man-made body of water, by surface area ranking behind only the Volta Reservoir in Ghana, and the U.S.S.R.'s V.I. Lenin Reservoir.

# Reservoir area LARGER THAN PRINCE EDWARD ISLAND

The Smallwood reservoir covers an area larger than Prince Edward Island. More than 40 miles of dykes — the largest about four miles long — help shape it. There are 88 dykes altogether, and more than 30 have been registered as large dams by the International Commission on Large Dams.

More than 26 million cubic yards of earth and rock fill went to build these dams — nearly twice the amount of material used in creating the islands for Expo 67.

When it is filled, the Smallwood reservoir will contain 1,000 billion cubic feet of water and will be about 2,200 square miles in area.

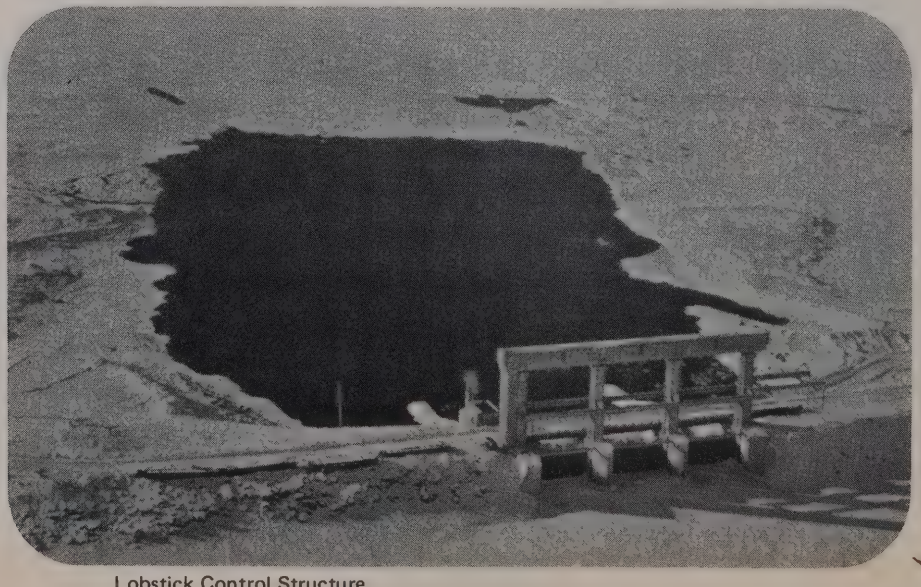
The water level will fluctuate about 28 feet between winter low and spring high.

Boosting the capacity of the Smallwood reservoir will be another — the Ossokmanuan. The latter has a capacity of about 100 billion cubic feet of water in its 320 square miles of area. It was built to supply the Twin Falls power plant (Brinco's first development in the area) which supplies energy to the iron mines of Western Labrador. Eventually Churchill Falls will pick up the Twin Falls load, and the Ossokmanuan reservoir will form part of the whole Churchill Falls reservoir complex. The latter will provide a flow to the powerhouse of 26,800,000,000 gallons a day, or about 105 times as much water as is used by the whole city of Montreal.

Seven major concrete spillways and control structures will regulate the water flow. They are the Jacopie spillway, the Forebay spillway, the intake, the Ossokmanuan spillway (Ossokmanuan is now a control structure but its eventual function will be that of a spillway) and three control structures: Gabbro, Lobstick and Whitefish Falls.

Lobstick is about 55 miles from the powerhouse intake. Its three gate openings are each 45 feet wide and 63 feet high and each gate weighs 250 tons.

The combined reservoir is fed by a catchment area of roughly 26,000 square miles, about a quarter the area of all Labrador.



Lobstick Control Structure

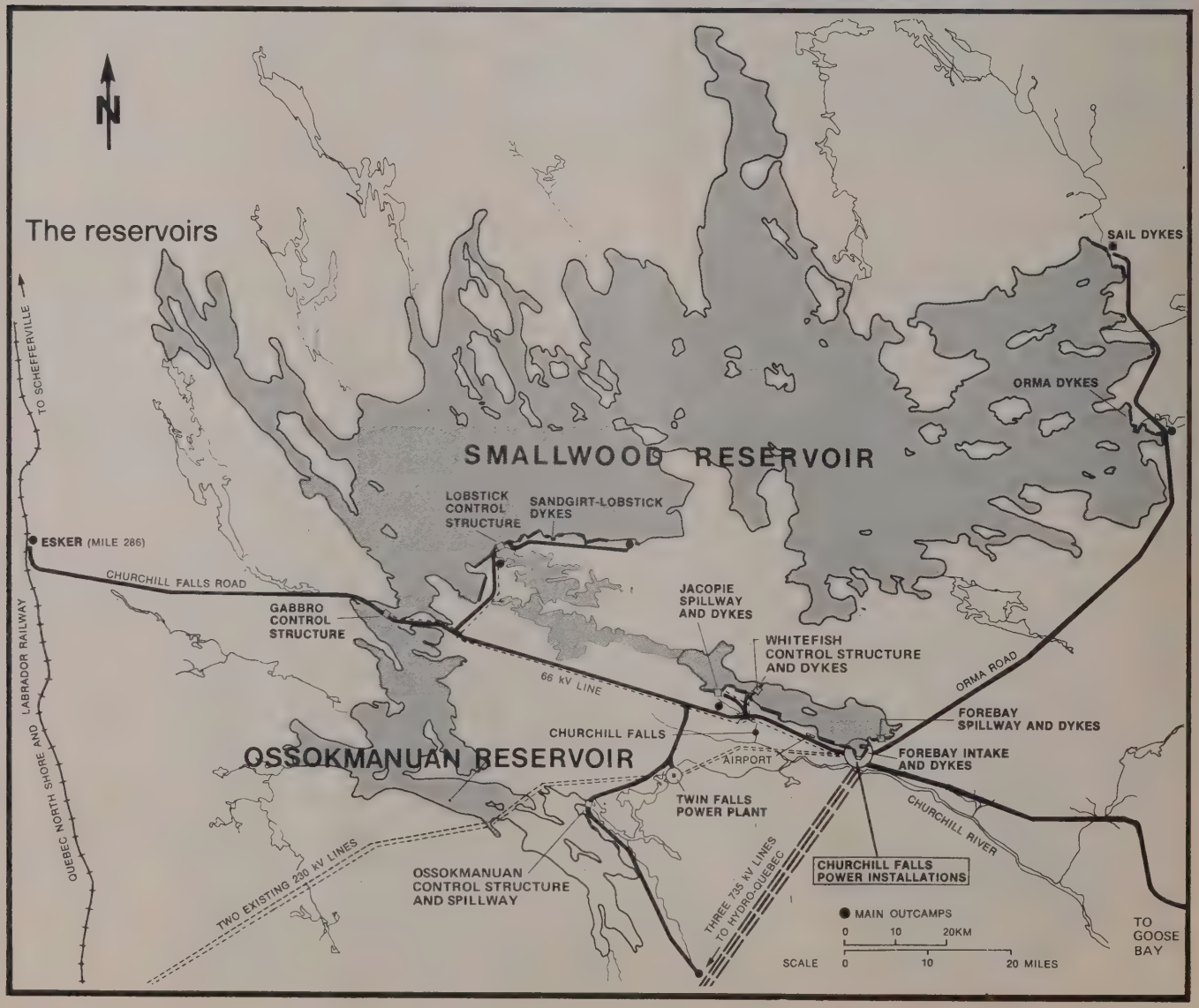
from page 7

Right:

DYKE GL 18, just west of the Lobstick Control Structure which can be (barely) seen in background is one of a total of 88 dykes. It is 105 feet high and more than two miles long.

Below:

The catchment area of the Upper and Lower Churchill River is 35,662 square miles. The Province of New Brunswick has an area of 28,343 square miles. The combined area of the states of Connecticut, New Hampshire, Massachusetts, Rhode Island and Vermont is 33,393 square miles.



# When it came to conductors for Churchill Falls, we gave it 100 per cent.

Churchill Falls is the largest single hydro-electric development in Canada. And the largest single-site source of power in the western world. Its total capacity is 5,225,000 kilowatts, or 7 million horsepower. And it can produce 34.5 billion kilowatt-hours annually.

We at Alcan Wire & Cable are proud to have supplied all of the A.C.S.R. conductors. They were produced at our Stephenville plant, whose highly-skilled employees are local residents.

Perhaps our most challenging project in over seventy years in the business, Churchill Falls enabled us to demonstrate our unequalled technical skill and expertise in both manufacturing and installing overhead conductors.

Special conductors of a proven Alcan design were used for the Churchill Falls River crossing. These conductors, of extra high-strength aluminum alloy and extra high-strength steel core, are examples of Alcan's world-wide leadership in alloying conductor metals for strength and conductivity.

Our vast experience in stringing conductors was also utilized throughout the project, with Alcan installation specialists helping the contractors solve difficult installation problems.

As we've probably already told you, there's no job too big or complex for us. Whatever the task, we always give it one hundred per cent.

**Alcan Wire & Cable**

ALCAN

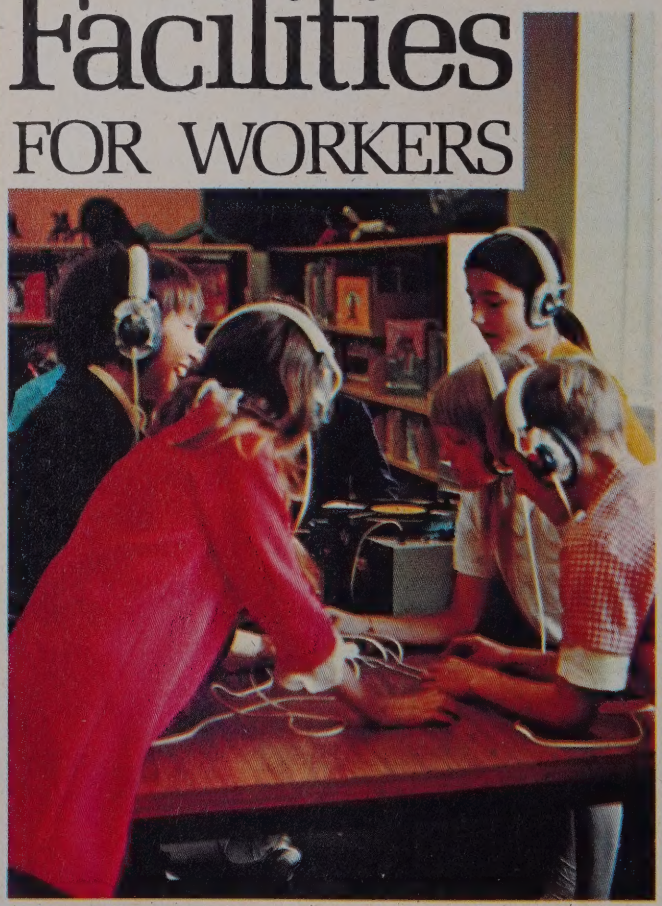
**Alcan makes it a little easier.**

At the peak of construction in 1970 there were more than 6,300 people in the field building the Churchill Falls development.

By the time the job is finished in 1975 the on-site work alone will have totalled about 52 million man-hours. Besides, many millions of man-hours of employment have been provided for industries engaged in providing the vast quantity of materials needed for the project. The turbines and generators alone, for instance, are providing about 7 million man-hours of work by the manufacturers and their suppliers.

Contributing to the good labor relations which have been evident throughout the construction period is an eight-year collective agreement between building trades labor unions and the contractors' association.

# COMPREHENSIVE Facilities FOR WORKERS



*The editorial material for this magazine was prepared for Churchill Falls (Labrador) Corporation Limited by Kenneth G. Wright.*

The whole complex is under the direction of Churchill Falls (Labrador) Corporation Limited (CFLCo), a subsidiary of Brinco Limited. The engineering and construction management was carried out by Acres Canadian Bechtel of Churchill Falls, on behalf of and under the direction of CFLCo. Acres Canadian Bechtel of Churchill Falls is a joint venture of H.G. Acres & Company Ltd. and Canadian Bechtel Ltd.

The work force needed to build the project was recruited almost wholly from Newfoundland and Labrador, and from Quebec. The workers have been housed in modern, inter-connected trailer units in a main camp. Nine satellite camps, serving outlying construction jobs, are equipped to accommodate from a few dozen to 600 men. The main camp provides such amenities as a post office which supplies normal city services, telephone, telegraph and teletype services, a branch bank, commissaries, a permanent hospital, movies and sports facilities. There are also Roman Catholic and Protestant ministries. As many of these services as feasible are also available in the outcamps.

A townsite, built in 1969 as part of the permanent community of Churchill Falls, is now being enlarged. Forty-five new houses will be added this year. The community will be the home of the operating staff after the project is completed.

The Town Centre groups under one roof a 21-room hotel, school, post office, bank and shopping and recreational facilities.

The shopping services include a grocery supermarket, a department store and a gift shop.

Recreational facilities comprise a 224-seat theatre/auditorium, a bowling alley, an artificial ice curling rink, and a gymnasium with facilities for basketball, volleyball and badminton, as well as a swimming pool.

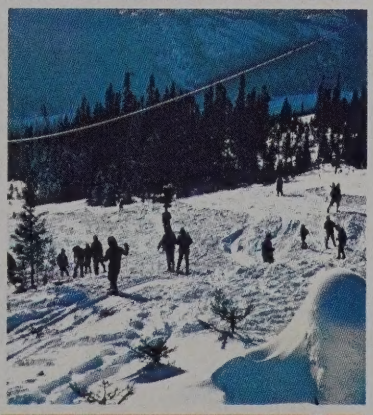
The school provides facilities for English and French courses from kindergarten through Grades 9 and 8 respectively. It is staffed by 22 qualified teachers and specialists and contains a resource centre which serves as a community library.

Housed separately is a 12-bed hospital, fully staffed.

The Canadian Broadcasting Corporation operates two low-power radio transmitters to provide network programming in French and English. The CBC also provides a television service in English and French in the evenings.

All the houses in the townsite have been built on one side of each well-laid-out paved street. This was done to provide privacy, take advantage of a southern view, and facilitate snow removal. Average yearly snowfall in the area is 154 inches.

The townsite is 700 miles from Montreal, 650 from St. John's and 1,000 from New York. Two airlines provide scheduled jet service to a modern airport.



Bank of Montreal
The First Canadian Bank

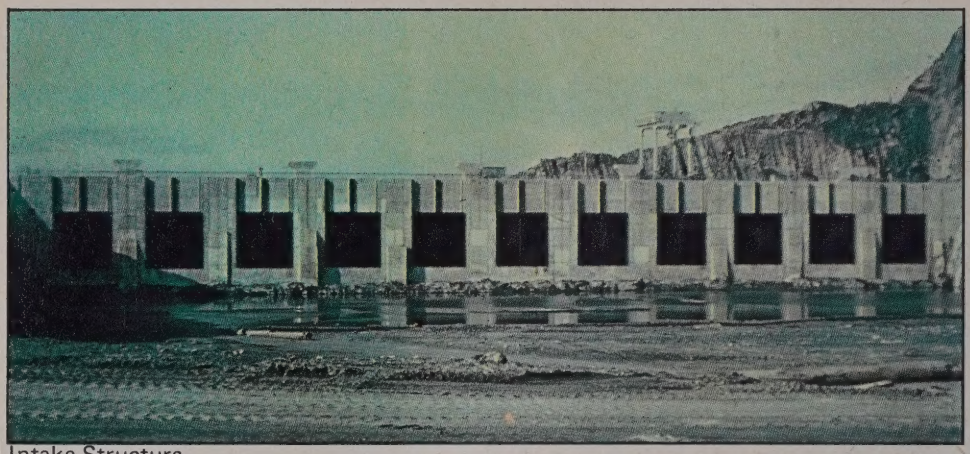
# Churchill Falls adds more power to the Canadian economy.

## We were happy to lend a hand.

Bank of Montreal. Principal Banker for Churchill Falls (Labrador) Corp. Limited.

# CHURCHILL CONSTRUCTORS

## a joint venture...



Intake Structure

Main Powerhouse Contract- Intake Structure and Concrete Lining of Penstocks

Powerhouse Excavation

**Partner Companies:**

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